CLAIMS:

1. An isolated nucleotide sequence corresponding to or complementary to at least about 35% of the nucleotide sequence comprising SEQ ID NO:5 (Figure 54).

2. The isolated nucleotide sequence of claim 1 wherein said sequence comprises SEQ ID NO:5.

3. The isolated nucleotide sequence of claims 1 or 2 wherein said sequence encodes a functionally active elongase which utilizes a polyunsaturated fatty acid as a substrate.

4. The nucleotide sequence of claim 1 wherein said sequence is derived from a mammal.

5. The nucleotide sequence of claim 4 wherein said sequence is derived from a mouse.

6. A purified protein encoded by said nucleotide sequence of claims 1 or 2.

7. A purified polypeptide which elongates polyunsaturated fatty acids and has at least about 30% amino acid similarity to the amino acid sequence of said purified protein of claim 6.

8. A method of producing an elongase enzyme comprising the steps of:

a) isolating a nucleotide sequence comprising SEQ ID NO:5 (Figure 54) or SEQ ID NO:6 (Figure 58);
b) constructing a vector comprising: i) said isolated nucleotide sequence operably linked to ii) a promoter;
c) introducing said vector into a host cell under time and conditions sufficient for expression of said elongase enzyme.

9. The method of claim 8 wherein said host cell is selected from the group consisting of a eukaryotic cell or a prokaryotic cell.

10. The method of claim 9 wherein said prokaryotic cell is selected from the group consisting of E. coli, Cyanobacteria, and B. subtilis.

11. The method of claim 9 wherein said eukaryotic cell is selected from the group consisting of a mammalian cell, an insect cell, a plant cell and a fungal cell.

12. The method of claim 11 wherein said fungal cell is selected from the group consisting of Saccharomyces spp., Candida spp., Lipomyces starkey, Yarrowia spp., Kluyveromyces spp., Hansenula spp., Aspergillus spp., Penicillium spp., Neurospora spp., Trichoderma spp. and Pichia spp.

13. The method of claim 12 wherein said fungal cell is a yeast cell selected from the group consisting of

Saccharomyces spp., Candida spp., Hansenula spp. and Pichia spp.

14. The method of claim 13 wherein said yeast cell is Saccharomyces cerevisiae.

15. A vector comprising: a) a nucleotide sequence comprising SEQ ID NO:5 (Figure 54) operably linked to b) a promoter.

16. A host cell comprising said vector of claim 15.

17. The host cell of claim 16, wherein said host cell is selected from the group consisting of a eukaryotic cell or a prokaryotic cell.

18. The host cell of claim 17 wherein said prokaryotic cell is selected from the group consisting of E. coli, Cyanobacteria, and B. subtilis.

19. The host cell of claim 17 wherein said eukaryotic cell is selected from the group consisting of a mammalian cell, an insect cell, a plant cell and a fungal cell.

20. The host cell of claim 19 wherein said fungal cell is selected from the group consisting of Saccharomyces spp., Candida spp., Lipomyces starkey, Yarrowia spp., Kluyveromyces spp., Hansenula spp., Aspergillus spp., Penicillium spp., Neurospora spp., Trichoderma spp. and Pichia spp.

21. The host cell of claim 20 wherein said fungal cell is a yeast cell selected from the group consisting of Saccharomyces spp., Candida spp., Hansenula spp. and Pichia spp.

22. The host cell of claim 21 wherein said host cell is Saccharomyces cerevisiae.

23. A plant cell, plant or plant tissue comprising said vector of claim 15, wherein expression of said nucleotide sequence of said vector results in production of a polyunsaturated fatty acid by said plant cell, plant or plant tissue.

24. The plant cell, plant or plant tissue of claim 23 wherein said polyunsaturated fatty acid is selected from the group consisting of AA, ADA, GLA and STA.

25. One or more plant oils or acids expressed by said plant cell, plant or plant tissue of claim 23.

26. A transgenic plant comprising said vector of claim 15, wherein expression of said nucleotide sequence of said vector results in production of a polyunsaturated fatty acid in seeds of said transgenic plant.

27. A transgenic, non-human mammal whose genome comprises a DNA sequence encoding an elongase, operably linked to a promoter, wherein said DNA sequence comprises SEQ ID NO:5 (Figure 54).

28. A fluid produced by said transgenic, non-human

mammal of claim 27 wherein said fluid comprises a detectable level of at least one elongase or products thereof.

29. A method for producing a polyunsaturated fatty acid comprising the steps of:

a) isolating a nucleotide sequence comprising SEQ ID NO:5 (Figure 54);

b) constructing a vector comprising said isolated nucleotide sequence;

c) introducing said vector into a host cell under time and conditions sufficient for expression of an elongase enzyme encoded by said isolated nucleotide sequence; and

d) exposing said expressed elongase enzyme to a substrate polyunsaturated fatty acid in order to convert said substrate to a product polyunsaturated fatty acid.

30. The method according to claim 29, wherein said substrate polyunsaturated fatty acid is selected from the group consisting of GLA, STA, AA, ADA and ALA, and said product polyunsaturated fatty acid is selected from the group consisting of DGLA, 20:4n-3, ADA, ω6-docosapentaenoic acid and STA, respectively.

31. The method according to claim 29 further comprising the step of exposing said expressed elongase enzyme to at least one desaturase in order to convert said product polyunsaturated fatty acid to another polyunsaturated fatty acid.

32. The method according to claim 31 wherein said product polyunsaturated fatty acid is selected from the group consisting of of DGLA, 20:4n-3, ADA and ω6-docosapentaenoic acid, said another polyunsaturated fatty acid is selected from the group consisting of AA, EPA, ω6-docosapentaenoic acid and docosahexaenoic acid respectively, and said at least one desaturase is Δ5-desaturase with respect to production of AA or EPA, and Δ4-desaturase with respect to production of ω6-docosapentaenoic acid, and Δ19-desaturase with respect to production of docosahexaenoic acid.

33. The method of claim 32 further comprising the step of exposing said another polyunsaturated fatty acid to one or more enzymes selected from the group consisting of at least one elongase and at least one additional desaturase in order to convert said another polyunsaturated fatty acid to a final polyunsaturated fatty acid.

34. The method of claim 33 wherein said final polyunsaturated fatty acid is selected from the group consisting of ADA, ω3-docosapentaenoic acid and docosahexaenoic acid.

35. A nutritional composition comprising at least one polyunsaturated fatty acid selected from the group consisting of said product polyunsaturated fatty acid produced according to the method of claim 29, said another polyunsaturated fatty acid produced according to the method of claim 31, and said final

polyunsaturated fatty acid produced according to the method of claim 33.

36. The nutritional composition of claim 35 wherein said product polyunsaturated fatty acid is selected from the group consisting of DGLA, 20:4n-3, ADA, ω6-docosapentaenoic acid and STA.

37. The nutritional composition of claim 35 wherein said another polyunsaturated fatty acid is selected from the group consisting of AA, EPA, ω6-docosapentaenoic acid and docosahexaenoic acid.

38. The nutritional composition of claim 35 wherein said final polyunsaturated fatty acid is selected from the group consisting of ADA, ω3-docosapentaenoic acid and docosahexaenoic acid.

39. The nutritional composition of claim 35 wherein said nutritional composition is selected from the group consisting of an infant formula, a dietary supplement and a dietary substitute.

40. A pharmaceutical composition comprising 1) at least one polyunsaturated fatty acid selected from the group consisting of said product polyunsaturated fatty acid produced according to the method of claim 29, said another polyunsaturated fatty acid produced according to the method of claim 31, and said final

polyunsaturated fatty acid produced according to the method of claim 33 and 2) a pharmaceutically acceptable carrier.

41. An animal feed comprising at least one polyunsaturated fatty acid selected from the group consisting of said product polyunsaturated fatty acid produced according to the method of claim 29, said another polyunsaturated fatty acid produced according to the method of claim 31 and said final polyunsaturated fatty acid produced according to the method of claim 33.

42. The animal feed of claim 41 wherein said product polyunsaturated fatty acid is selected from the group consisting of DGLA, 20:4n-3, ADA, ω6-docosapentaenoic acid and STA.

43. The animal feed of claim 41 wherein said another polyunsaturated fatty acid is selected from the group consisting of AA, EPA, ω6-docosapentaenoic acid and docosahexaenoic acid.

44. The animal feed of claim 41 wherein said final polyunsaturated fatty acid is selected from the group consisting of ADA, ω3-docosapentaenoic acid and docosahexaenoic acid.

45. A cosmetic comprising a polyunsaturated fatty acid selected from the group consisting of said product polyunsaturated fatty acid produced according to the method of claim 29, said another polyunsaturated fatty

acid produced according to the method of claim 31 and said final polyunsaturated fatty acid produced according to the method of claim 33.

46. A method of preventing or treating a condition caused by insufficient intake of polyunsaturated fatty acids comprising administering to said patient said nutritional composition of claim 35 in an amount sufficient to effect said prevention or treatment.

47. An isolated nucleotide sequence corresponding to or complementary to at least about 35% of the nucleotide sequence comprising SEQ ID NO:6 (Figure 58).

48. The isolated nucleotide sequence of claim 47 wherein said sequence comprises SEQ ID NO:6.

49. A purified protein encoded by said nucleotide sequence of claims 47 or 48.